

**U.S. PATENT APPLICATION**

**for**

**SEPARABLE APPARATUS TO CUSHION AND DAMPEN**

**VIBRATION AND METHOD**

Inventors:     Bruce C. Polzin  
                     Jeffrey E. Larson

## **SEPARABLE APPARATUS TO CUSHION AND DAMPEN VIBRATION AND METHOD**

### **CROSS REFERENCE TO RELATED PATENT APPLICATION**

**[0001]** This application is a continuation-in-part of Application No. 10/099,145, filed March 15, 2002.

### **BACKGROUND OF THE INVENTION**

**[0002]** The present invention relates generally to the field of vibration dampening and more particularly to a separable apparatus to cushion and dampen vibration with a micro-cellular foaming layer between two non-foaming layers.

**[0003]** Conventional methods for dampening vibration include the use of springs, weights and combinations of different materials. In the area of tools, particularly hand tools, a typical vibration dampening technique is to utilize a "substrate" grip material attached or bonded to a hard or rigid substrate. Such tools typically are a hammer, screwdriver, grips on pliers but can also include a toothbrush. The substrate material can include low concentrations of foaming agents to prevent sink in a thicker molded part such as a solid paintbrush handle. Foaming agents have been used to foam the entire substrate and may be referred to as structural foam. Such techniques are used to reduce the amount of material in the molded parts. Another technique is the use of a "gas assist" molding process to create large air bubbles or voids in the center of a part to remove material, or increase cycle time or make the part lighter. An example of such a molded part is an interior automobile door handle.

**[0004]** The utilization of processes and products that have employed foaming or blowing agents with injection molding of tools or apparatus, examples such as mentioned above typically use non-elastomeric thermoplastic materials such as polypropylene, polyethelyne, nylon or filled thermal plastic materials such as glass filled nylon but not with thermoplastic elastomers.

**[0005]** In cases where thermal plastic elastomers have been utilized with foaming agents, it typically is for purposes of reducing the end product weight. For example, polyurethane can be extruded and/or cast with foaming agents to create a bun similar to a loaf of bread. In such case, the bubbles of the foaming agent are random in size and throughout the bun from the bottom to the top and left to right. An example of a product made from this process is the foam rubber used in chair cushions. Similarly, polyvinylchloride can be extruded with a foaming agent to create pipe insulation wraps. Such product is formed with bubbles randomly spaced throughout the end product. Such described processes do not utilize injection molding or control the size or location of the foaming agent used with the thermal plastic elastomers.

**[0006]** Desired characteristics of an apparatus to cushion and dampen vibrations would provide a hard thermoplastic elastomer material molded using an additive and processed to achieve a softer feel while retaining the physical properties of the harder material. The principal desirable characteristic is to have a micro-cellular "honeycombed" zone coupled to an apparatus such as a tool, which reacts similar to a gas filled shock absorber in that it compresses under pressure applied to the surface of the gripping area but rebounds after the pressure is released.

**[0007]** Thus, there is a need for a separable apparatus to cushion and dampen vibration transmitted through the apparatus to a user. There is a further need for a separable apparatus to cushion and dampen

vibration that provides a surface hardness similar to that of a solid material but with an apparent softness in selected zones utilized for gripping or contacting the apparatus. There is additional need for a handle for a tool, particularly a hand held tool that will cushion and dampen vibrations transmitted through the tool to the user of such tool. In addition, there is a need for a separable apparatus that will cushion and dampen vibrations transmitted between components of a tool, such as electrical components and delicate features of an associated device.

#### SUMMARY OF THE INVENTION

**[0008]** The present invention provides a separable apparatus to cushion and dampen vibration. The apparatus comprises an overmold composed of a mixture of an elastomeric material and a foaming agent. The overmold comprises a first non-foam layer and a second non-foam layer, in conjunction, enveloping a micro-cellular foam layer.

**[0009]** There is also provided a tool comprising a tool-head and a grip coupled to the tool-head. The grip has a base with a separable overmold member disposed on the grip. The separable overmold member is composed of a mixture of an elastomeric material and a foaming agent. The overmold member comprises a first non-foam layer and a second non-foam layer, in conjunction, enveloping a micro-cellular foam layer.

**[0010]** There is further provided a method to make a separable apparatus for a tool in a mold. The separable apparatus is to cushion and dampen vibration. The separable apparatus includes an overmold composed of a mixture of an elastomeric material and a foaming agent. The overmold comprises a first non-foam layer and a second non-foam layer in conjunction, enveloping a micro-cellular foam layer. A method comprises the steps of providing a substrate member in the mold, then molding the overmold on the substrate member, wherein the apparatus is

made. Removing the apparatus from the mold and controlling environmental conditions, to which the apparatus is subjected during one of a time the apparatus is in the mold and a time after the apparatus is removed from the mold. Another embodiment includes the step of removing the apparatus from the substrate member.

**[0011]** There is also provided a tool. The tool comprises a tool head, a grip coupled tool head, with the grip defining a void. The separable overmold member is configured to fill the void. The overmold member is composed of a mixture of an elastomeric material and a foaming agent. The separable overmold member comprises a first non-foam layer and a second non-foam layer, in conjunction, enveloping a micro-cellular foam layer.

**[0012]** Additionally, there is provided a tool. The tool comprises a means for working, a means for holding and a separable overmold member. The means for holding is coupled to the means for working, with the means for holding defining a void. The overmold member is configured to fill the void. The overmold member is composed of a mixture of an elastomeric material and a foaming agent, comprising a first non-foam layer and a second non-foam layer, in conjunction, enveloping a micro-cellular foam layer.

**[0013]** There is additionally provided a handle for a tool. The handle for a tool comprises a base having a grip portion and a tool head portion. A separable overmold member is associated with the grip portion. The overmold member is composed of a mixture of an elastomeric material and a foaming agent. The overmold member comprises a first non-foam layer and a second non-foam layer, in conjunction, enveloping a micro-cellular foam layer.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] Fig. 1 is a cross-sectional illustration of a prior art handle depicting a solid grip portion coupled to a base.

[0015] Fig. 2 is a cross-sectional illustration of an alternative embodiment of a prior art handle depicting a solid grip portion coupled to a base.

[0016] Fig. 3 is a perspective view of an exemplary embodiment of a molded foam resin handle for a tool.

[0017] Fig. 4 is a sectional view of the molded foam resin handle illustrated in Fig. 3 along the line 4-4.

[0018] Fig. 5 is a partial cross-sectional view of an exemplary embodiment of an apparatus to cushion and dampen vibration, with the overmold bonded to the substrate member.

[0019] Fig. 6 is a sectional view of the apparatus illustrated in Fig. 5 along the line 6-6.

[0020] Fig. 7 is a partial cross-sectional view of an exemplary embodiment of an apparatus to cushion and dampen vibration with the overmold mechanically attached to the substrate member.

[0021] Fig. 8 is a partial cross-sectional view of a handle for a tool illustrating the overmold configured in a predetermined shape.

[0022] Fig. 9 is a perspective view of a drill type tool including an exemplary embodiment of a separable apparatus to cushion and dampen vibration, with the separable apparatus configured as a sleeve.

[0023] Fig. 10 is a partial sectional view of the separable apparatus illustrated in Fig. 9 along the line 10-10, illustrating the sleeve configuration on to the base portion of the tool.

[0024] Fig. 11 is a perspective view of a drill-type tool including an exemplary embodiment of a separable overmold member disposed in a void of a base portion of the tool grip.

**[0025]** Fig. 12 is a partial perspective view of a grip of a tool, with the grip defining a void and an exemplary embodiment of separable overmold member configured to fill the void.

**[0026]** Fig. 13 is a partial perspective view of a separable overmold member disposed on a handle of a tool.

**[0027]** Fig. 14 is a partial section view of the separate overmold member illustrated in Fig. 11 along the line 14-14.

**[0028]** Fig. 15 is a perspective view of a grip apparatus of a tool having a plurality of pockets configured to contain a separable overmold member.

**[0029]** Fig. 16 is a sectional view of a separable overmold member coupled to a base or substrate member.

**[0030]** Fig. 17 is a schematic of a mold having a substrate member and illustrating an exemplary embodiment of a separable overmold member removed from the substrate member.

#### DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

**[0031]** Referring to the figures, Figs. 1 and 2 illustrate two embodiments of prior art handles. Fig. 1 illustrates a grip portion coupled to a base portion of a handle with a grip portion being a solid material. Fig. 2 also illustrates a prior art handle with a grip portion coupled to the base which the grip conforms to the shape of the base of the handle.

**[0032]** Prior art applications of a foaming agent with other materials such as polypropylene will not provide the characteristics sought in the present application. For instance, prior art applications, such as for audio speakers. In such application, the layers of rigid and foamed polypropylene are configured to enhance vibration. This is generally accomplished by having a high rigidity of the end product with a thin cross-section. In contrast, the present apparatus has characteristics of

being flexible that dampens vibration. The present apparatus also utilizes elastomers to provide flexibility to facilitate structural variances and apparent softness techniques. As previously discussed, such prior art configurations do not provide the characteristics of a solid outer skin with an apparent softness that cushions and dampens vibration transmitted through the base of the tool.

**[0033]** Figs. 3-8 illustrate several exemplary embodiments of an apparatus to cushion and dampen vibration comprising a substrate member 14 also referred to herein as a base, and an overmold 20 disposed on and attached to the substrate member 14. The overmold 20 is composed of a mixture of an elastomeric material 21 and a foaming agent 23. The overmold 20 comprises a first non-foam layer 22 and a second non-foam layer 24, in conjunction, enveloping a micro-cellular foam layer 26. See particularly Figs. 4-8. Inherent characteristics of the non-foam layers include tear resistance, solvent resistance, and tactile feel as compared to prior art solid, non-foamed elastomers.

**[0034]** The elastomeric material 21 is a thermal plastic elastomer (TPE) that is selected from a group comprising thermal plastic olefins, thermalplastic rubbers, thermalplastic polyurethanes, polyvinylchlorides, styrenic block copolymers and can be combinations of one or more of such materials. The TPE plastic resin comes in pellet form that may require the removal of moisture from the resin if it becomes hydroscopic. The TPE material is used in standard injection molding machinery together with standard injection molding tooling. Because of the nature of the mixture of elastomeric material 21 and the foaming agent 23 (as will be described hereinafter), a shut-off nozzle should be used with the injection molding machine to prevent the TPE material from drooling out of the nozzle tip between injection shots. Although injection molding is discussed and described herein, it is also contemplated that other types of

molding techniques can be adapted to produce the apparatus described herein, for example, transfer molding techniques, or blow molding, or open pour-casting molding techniques can be utilized.

**[0035]** The particular type of elastomeric material 21 that is to be selected by the designer of the apparatus 6 or the operator of the molding process will depend on the particular application for which , the tool 5 being manufactured will be utilized. For example, a polyurethane holds heat for a much longer time period than a polypropylene based TPE material. Such heat retention will affect the heat activated foaming agent and will require different controlling techniques as will be discussed hereinafter.

**[0036]** There are five primary factors that are needed to be controlled to produce an apparatus 6 that exhibits the desired characteristics as described above. Those factors include material selection, foaming agent 23 and elastomeric material 21 concentration, thickness of the non-foam layer 22, 24 and the foam layer 26 (for example, control by the geometry of the mold), temperature (temperature of the mixture, of the mold, and of ambient air) and the time at various stages during the manufacturing process.

**[0037]** The elastomeric material 21 and the foaming agent 23 are typically mixed in the injection molding machine. Heaters in the injection molding machine heat the mixture to above the melting point of the components causing the foaming agent to mix with the thermoplastic elastomer. The elevated temperature activates the foaming agent 23 to start to expand, however, the mixture is constrained in the injection molding machine and is prevented from expanding further. It has been determined that a TPE material with greater heat retention affords a larger processing window during the manufacturing process.

**[0038]** The TPE material 21 can be advantageously compatible with the material used in the substrate member or base 14. However, it is also advantageous to compose the TPE material 21 not to be compatible with the substrate member or base 14 so that a bond is not formed and the separable apparatus 6 can be removed or decoupled from the substrate 14. The shape of the base 14 can vary, for example it can be elongated or asymmetrical.

**[0039]** The melted mixture of elastomeric material 21 and the foaming agent 23 is injected into a mold cavity of a mold through a conventional injection mold runner system. The substrate member or base 14 may be already placed in the mold cavity by manual insertion or by molding it in place prior to injecting the melted mixture of elastomeric material 21 and foaming agent 23 forming the overmold 20. The mixture is injected into the mold cavity and constrained within the mold cavity again inhibiting the foaming expansion of the foaming agent 23. When the mold cavity is filled, the shut-off nozzle closes stopping an injection of the mixture into the mold cavity.

**[0040]** Once the mixture of the elastomeric material 21 and foaming agent 23 enters the mold cavity, the cooler temperature of the mold begins to act as a heat sink and lowers the temperature of the mixture at the interface between the mixture and the mold cavity. The hot mixture of elastomeric material 21 and foaming agent 23 transfers heat to substrate member 14 and bonds together creating a bond between the overmold 20 and the substrate 14. The second non-foam layer 24 is formed at that interface (See Figs. 4-8). The cooling of the mixture forming the overmold 20 on both sides of the form begins to form a skin or non-foaming layer 22, 24 with virtually no expansion, thus creating a skin that is the same as a solid molded resin. As the skin cools, the lowering of the mixture temperature within the skin removes

the activation temperature from the foaming agent 23 thereby stopping the expansion of the foaming agent 23 within the skin or non-foam layers, 22, 24. The interior portion of the overmold 20 which is where the micro-cellular foam layer 26 is located, continues to foam and expand but only to the point of filling the available space. At this juncture, various control techniques can be utilized by an operator of the injection molding system to make the apparatus desired. It is the controlling of the environmental conditions to which the apparatus 6 is subjected during one of a time the apparatus is in the mold and a time after the apparatus 6 is removed from the mold that will govern the final product.

[0041] After an appropriate time to be determined by an operator of the injection molding machinery, the tool 5 and apparatus 6 is removed from the mold. Removing the apparatus 6 from the mold also removes any confinement about the elastomeric material 21 and continued expansion of the foaming agent 23 can take place. Such activity stretches the first and second non-foam layers, 22, 24 of the overmold 20 as the expansion force created by the foaming agent 23 pushes against the two layers. During this process, ambient air continues to act as a heat sink cooling down the outer surface of the skin. Ambient air around the tool 5 and apparatus 6 can be controlled which will affect the final product. As the overmold 20 continues to cool, it becomes less elastic and slows down the foaming agent 23 activity which in turn reduces the expansion forces exerted against the non-foam layers, 22, 24.

[0042] Additional factors that can be controlled during the process include controlling the temperature of the elastomeric material 21 by various heating techniques such as heating coils or hot air flows. Also, the temperature of the mold can be controlled by various well known and convenient techniques to accelerate or inhibit the effect of the

foaming agent 23. The thickness of the elastomeric material 21 can be controlled by configuring the geometry of one of the substrate material 14 and the mold. An example of the changed geometry of the mold is shown in Fig. 5 and a change in the geometry of the substrate 14 on the overmold 20 is illustrated in Fig. 8.

**[0043]** The ratios between the foaming agent 23 and the elastomeric material 21 is also an important control factor in the final overmold 20 structure and apparatus 5 configuration. The type of foaming agent needs to be matched with the type of TPE based material being used for the apparatus to insure compatability. The foaming agent 23 can be wet or dry, solid, liquid or gas. While various foaming agents may be used, it has been determined that to produce the appropriate micro-cellular foam layer 26, an endothermic foaming agent is used. The concentration of foaming agent 23 influences the effects of the microcells created in the foam layer 26. Typical concentrations of foaming agent 23 used with the elastomeric material 21 range between 1.0-10.0 percent. To create selected pockets of foaming within the foam layer 26 of the overmold 20 a higher concentration of foaming agent 23 in the range of 2 to 8 percent or more is desirable. Applicants have determined that the use of Endex International's ABC27500® endothermic chemical foaming agent can be used for both the polyurethane and polypropylene based TPE elastomeric material 21.

**[0044]** The thickness or geometry of the non-foam layers 22, 24 of the overmold 20 can influence the degree of micro-cellular bubbles created in the overmold 20 and the expansion of the non-foam layers 22, 24 as discussed above. The thicker the cross-section of the foamed TPE in the foam layer 26, the more the selected micro-cellular area of foaming will be, thus causing more expansion of the surface layers 22, 24 of the overmold 20. In some cases, the thickness of the foam layer 26 exceeds

the combined thickness of the non-foam layers 22, 24. In another embodiment, the combined thickness of the non-foam layers 22, 24 exceeds the thickness of the foam layer 26. Fig. 5 illustrates the thickness of the foam area in different areas of the grip portion 16 of the base 14.

**[0045]** Controlling of the foaming agent, by the several processes described above, will affect the characteristics of the overmold 20. For example, too much expansion will create fewer but larger bubble cells and a larger expansion surface of the overmold 20. However, the honeycomb structure of the few large cells is not as strong as many smaller cells, with interlocking cell walls. If the foaming agent was allowed to expand to create a single bubble cell, it would not have any interlocking cell walls and would have very little internal strength.

**[0046]** To obtain the desired affect, the material thickness of the non-foam layers 22, 24 and the foam layer 26 must be selected and controlled with concentration of the foaming agent 23/and elastomeric material 24, the temperatures of the mixture, the mold and of the ambient air and the time of reaction to achieve the desired affects for the overmold 20. Varying thicknesses of the layers within the same overmold 20 may be desired if the overmold 20 needs to have different zones of different degrees of cushioning. Figs. 5, 7 and 8 illustrate several exemplary embodiments of varying thicknesses of the foam layer 26 within the overmold 20.

**[0047]** As mentioned above, temperature is a factor in influencing the degree of micro-cellular bubbles created in the foaming layer 26 and the expansion of the surface skin, the first and second non-foam layers 22, 24 of the overmold 20. The higher the melt temperature of the mixture of elastomeric material 21 and foaming agent 23 the more heat the activated foaming agent 23 will create bubbles. These bubbles

will increase in number and size with the increased heat. As the number and size of the cell bubbles increase, the expansion of the skinned surface 22, 24 will increase creating an apparent softer material. The control of the temperature of the mixture can be controlled by varying the temperature of the mold using convenient and conventional methods or by controlling the ambient air in which the apparatus 5 is exposed upon removal from the mold.

[0048] Various time factors also influence the creation of the overmold 20 with the desired characteristics. The injection time to fill the cavity has some influence. The faster the melted mixture of elastomeric material 21 and foaming agent 23 is injected into the mold cavity, the less heat loss will occur during filling. The time the apparatus 5 is kept in the mold die under hold pressure, the cooler die material will retard the creation of the micro-cellular air pockets in the foaming agent 23 because the colder mold continually withdraws the heat from the mixture. In addition to cooling the mixture, maintaining the mixture of elastomeric material 21 and foaming agent 23 within the mold cavity prevents the expansion of the first and second non-foaming layers 22, 24 which impacts on the thickness of such layers. One effect of maintaining the apparatus 6 within the mold is that the compression effects of the injection force and the constraints of the mold overcome the force of the expanding foaming agent 23 and prevent the formation of micro-cellular voids within the foam layer 26 thereby providing a less soft effect. At such time as the apparatus 6 is removed from the mold, various procedures can be utilized to control the final shape of the overmold 20. For example, various restraining devices can be utilized such as a collar or a band pressing against the non-foam layers 22, 24 to retard the micro-cellular formation in that particular area.

**[0049]** The overmold 20 can be attached to the substrate member or base 14 by mechanical means such as illustrated in Figs. 5, 6 and 7. Figs. 5 and 6 illustrate an encapsulation of the base 14 by the overmold 20. The tools 5 where such encapsulation might be utilized can be for example at the end of a writing instrument or toothbrush. Another technique of mechanically attaching the two non-foam layers, 22, 24 and the foam layer 26 to the substrate member 14 is illustrated in Fig. 7 wherein an opening in the base 14 is filled by the second non-foaming layer 24 of the overmold 20 thereby securing the overmold 20 to the base 14. It is also contemplated that fasteners such as rivets, screws or the like can be utilized to attach an overmold 20 to a base 14. Pockets 12 formed in the base 14 can also be used to contain the overmold 20. The pockets can be longitudinal or radial or angled. Additional mechanical attachments can be utilized, such as for example nubs on the base 14 or holes in the base 14.

**[0050]** The overmold 20 can also be bonded to the substrate 14 as illustrated in Fig. 8. The bonding can occur at the molecular level between the elastomeric material 21 of the overmold 20 and the substrate member 14 provided that the materials are chemically compatible. It is also contemplated that adhesives such as glue, epoxy or the like can be utilized to attach the overmold 20 to the substrate member 14.

**[0051]** The substrate member 14, also referred to as a base 14, can be selected from a group of materials, including wood, metal, thermoplastic resin, thermalset resin, epoxy, ceramic, glass and a combination of any two such materials. For example, a metal or fiberglass core surrounded by a thermoplastic resin can form the substrate member 14 upon which the overmold 20 is disposed during the manufacturing process. It is also contemplated that the substrate

materials can be molded in the injection molding machine first and then the overmold 20 injection molded and disposed upon the substrate member 14.

**[0052]** The tool 5 can also be configured to comprise a tool head 18 with a grip 16 coupled to the tool head 18. The grip 16 would include a base 14 with an overmold 20 disposed on the grip 16, with the overmold 20 composed of a mixture of an elastomeric material 21 and a foaming agent 23 comprising a first non-foam layer 22 and a second non-foam layer 24 in conjunction, enveloping a micro-cellular foam layer 26. The tool head exemplary embodiment, illustrated in Fig. 3 can be the head of a hammer, the blade of a screwdriver, the motor and chuck of a drill, the blades of scissors or shears, the blade of a chisel and such other and suitable and convenient devices. It is also contemplated that the apparatus 6 having a substrate member 14 and an overmold 20 can be utilized as a bumper or a handle for a door such as in an automobile. With either or both, the substrate member 14 or the overmold 20 being configured to any suitable and convenient shape as determined by the molding process or by post-mold processes as described above can be utilized to configure the apparatus 5 to any suitable application.

**[0053]** Referring now to figures 9-17, several exemplary embodiments of a separable apparatus to cushion and dampen vibration are illustrated. The separable apparatus 6 comprises an overmold member 20 composed of a mixture of elastomeric material 21 and a foaming agent 23. The overmold member 20 comprises a first non-foam layer 22 and a second non-foam layer 24, in conjunction with the first layer enveloping a micro-cellular foam layer 26. The separable apparatus 6 can be manufactured by molding as described above, however, its composition is such that it does not bond to the mold substrate member 41 during the molding process. As will be described below, the separable apparatus 6

can be removed from the mold substrate member 41 while the latter is still in the mold or the mold substrate member 41 and the separable apparatus 6 can be removed from the mold for post processing.

[0054] The separable overmold member 20 is molded onto a substrate 41 that has "very little" adhesive characteristics that produces very minimal to no bonding between the separable overmold member 20 and the substrate member 41. Examples of the substrates and overmolds that would have little or no bonding characteristics are: Delrin substrate and thermoplastic urethane overmold, glass filled nylon and standard grades of thermoplastic rubber thermoplastic rubbers that have not been modified for adhesion to nylon, specially treated metals such as polytetrafluoroethylene coated steel as well as numerous other substrates and elastomeric overmolds that are composed of a mixture of an elastomeric material 21 and a foaming agent 23.

[0055] Once the separable overmold member 20 has been molded on the substrate 41 and the expansion has taken place and the first skin layer 22, microcellular layer (foam layer) 26 and second skin 24 layer has been created, the separable overmold 20 is decoupled from the substrate 41 since the bonding between the overmold 20 and the substrate member 41 are minimal, if at all. This creates a separable apparatus 6 that exhibits the desired microcellular characteristics without being attached to a substrate member 41.

[0056] The resultant unitary microcellular apparatus 6 can then be used to dampen vibration or cushion an other apparatus, such as a tool 5. For example it can become a sleeve or a separate part to attach to a component that itself can't be injection molded or placed in a mold; such as electrical, fragile or non-bonding components, for example electrical circuits, glass, certain types of metal or certain types of wood.

[0057] Applicants have determined that it is possible to mold the overmold 20 without a substrate 41 to create the single microcellular apparatus 6 which can be used by itself or attached to another component.

[0058] Figures 9 and 10 illustrate an exemplary embodiment of a separable apparatus 6 to cushion and dampen vibration. In figure 9, the overmold member 20 is configured as a sleeve fitting on a grip 16 portion of a tool 5. Figure 10 illustrates a cross-section of the overmold member 20 which can be moved on or off of the base of the grip portion 16 of the tool 5. Figure 10 also illustrates the variation in foaming agent 26 thickness in relation to the first non-foam layer 22 and the second non-foam layer. Such variation in geometry can be controlled by the geometry of the mold 40 or other post-processing techniques as described above. Figures 11, 12 and 14 illustrate exemplary embodiments of a separable overmold member 20 configured to fill a void 17 defined in the grip 16 of a tool 5. It should be understood that the tool illustrated is an exemplary embodiment, for example, of a drill. However, any type of conventional and convenient tool 5 can accommodate the invention disclosed herein. For instance, the tool 5 can be configured as a toothbrush with the tool head 18 being a brush, or a spray gun with the tool head being a nozzle.

[0059] Figure 12 illustrates an exemplary embodiment of a predetermined shaped, separable overmold member 20 which is coupled to the grip 16 portion of a tool 5 and further configured to fill the void 17 in the grip portion 16. Figure 14 is a cross section of the separable overmold member 20 illustrated in figure 11. Figure 13 is an illustration of an exemplary embodiment of predetermined shape of the separable overmold member 20 which is bonded to the handle 10 of a tool 5. The bonding can be accomplished in any convenient and conventional manner such as an adhesive, for example, epoxy or glue or a chemical bond

formed between the material of the handle 10 and the separable overmold member 20. The overmold member 20 can also be fastened to the handle 10 of the tool 5 by mechanical means such as a fastener or a clamp or the like.

**[0060]** In determining the shape of the separable apparatus 6, the separable overmold member 20 is configured by the shape of the mold 40 and by additional processes as described above. In addition, the various environmental control factors, also described above are applicable to the formation of the separable apparatus 6. By controlling the mold geometry and the environmental factors, the thickness of the foam layer 26 can be configured to exceed the combined thickness of the non-foam layers 22, 24 or the combined thickness of the non-foam layers, 22, 24 can exceed the thickness of the foam layer 26 or the combined thickness of the non-foam layers 22, 24 can be equal to the thickness of the foam layer 26. (See figure 16). Figure 15 illustrates an exemplary embodiment of a tool 5 having a grip portion 16 with a plurality of pockets 12 filled by separable apparatus 6 with the separable overmold member 20 showing. It should be understood that the overmold members 20 can be individual pieces or a single piece folded within the grip portion 16 of the tool. The final configuration of the separable apparatus 6 is determined by the manufacturer or designer taking into account the type of tool 5 to be used and the application of the tool during its use.

**[0061]** There is also disclosed a method to make a separable apparatus 6 for a tool 5 in a mold 40. The separable apparatus 6 cushions and dampens vibration in use. The separable apparatus includes an overmold 20 composed of the mixture of an elastomeric material 21 and a foaming agent 23 comprising a first non-foam 22 layer and a second non-foam layer 24 in conjunction enveloping a microcellular foam layer 26. Referring to figure 17, a method comprises the steps of

providing a substrate member 41 in the mold 40 and molding the overmold 20 on the substrate member 41 wherein the apparatus 6 is made. In removing the apparatus 6 from the mold 40 and controlling the environmental conditions to which the apparatus 6 is subjected during one of a time the apparatus 6 is in the mold 40 and a time after the apparatus 6 is removed from the mold 40. The controlling of the environmental conditions are described above.

**[0062]** Another embodiment of the method includes the step of removing the apparatus 6 from the substrate member 41. The substrate member 41 can be configured as a part of the mold 40 or it can be a separate insert acting as a temporary carrier during the molding process. As described above, the mold substrate member 41 can also be injected molded itself in the first step of a two step molding process with the second step being the molding of the separable overmold member 20. The overmold member 20 or the mold substrate member 41 and overmold member 20 can be removed from the mold by either a machine or manually. The overmold member 20 can also be removed directly from the mold substrate member 41 either by machine or manually.

**[0063]** Separable apparatus 6 can be utilized either as a replacement part, an upgrade or retrofit for various tools. It is also contemplated that the separable apparatus 6 for controlling and dampening vibration can be utilized as a bumper, for example, as a doorstop, or a chair rail, or door handle or the like.

**[0064]** Thus there is provided a separable apparatus with characteristics of a surface layer having an apparent softness and a shock absorber affect to cushion and dampen the vibrations transmitted through the apparatus. While the embodiments illustrated in the figures and described above are presently preferred, it should be understood that these embodiments are offered by way of example only. The invention is

not intended to be limited to any particular embodiment but is intended to extend to various modifications that nevertheless fall within the scope of the appended claims. Other modifications will be evident to those with ordinary skill in the art.